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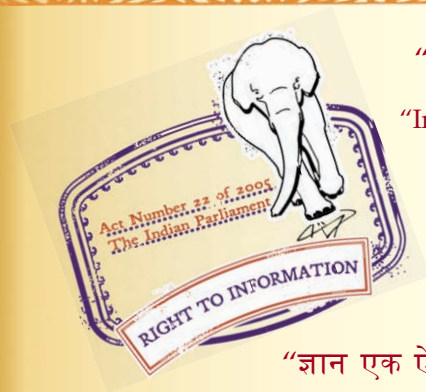
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“पुराने को छोड़ नये के तरफ”

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IS 5099 (2003): Technical Supply Conditions for Twist Drills [PGD 32: Cutting tools]



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“Knowledge is such a treasure which cannot be stolen”

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IS 5099 : 2003

भारतीय मानक
ऐंठित बरमों की तकनीकी पूर्ति शर्तें
(दूसरा पुनरीक्षण)

Indian Standard
TECHNICAL SUPPLY CONDITIONS FOR
TWIST DRILLS
(*Second Revision*)

ICS 25.100.30

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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FORWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Drills, Reamers and Threading Tools Sectional Committee had been approved by the Basic and Production Engineering Division Council

This standard was first published in 1969. Subsequently it was revised in 1983. This standard has been revised again based on the latest practices followed in Indian industries. In the present revision assistance has been derived from ISO 10899:1996 'High-speed steel two flute twist drills — Technical specifications', issued by the International Organization for Standardization (ISO). In this revision following changes have taken place

- a) Tolerance for parallel shank, cone tolerance, web symmetry, relative lip heights and flute spacing have been specified,
- b) Composition of material of test billet has been changed, and
- c) Speed for testing of HSS twist drills have been changed

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off values should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 DECEMBER 2006
TO
IS 5099 : 2003 TECHNICAL SUPPLY CONDITIONS
FOR TWIST DRILLS

(Second Revision)

(Page 1, clause 2) — Substitute 'IS 1570 (Part 2/Sec 1) 1979 Schedule for wrought steels Part 2 Carbon steels (unalloyed steels), Section 1 Wrought products (other than wires) with specified chemical composition and related properties (first revision)' for 'IS 1570 (Part 1) 1978' and its corresponding title

(Page 1, clause 4, Note) — Substitute 'XT72W18Cr4V1' for 'T72W18Cr4V1'

(Page 2, clause 6.3.2, first sentence) — Add the word 'of' between 'portion' and 'drill'

(Page 2, clause 6.6.2, first para) — Substitute '6.6.1' for '6.2.1'

(Page 4, clause 6.7, first line) — Substitute 'Fig 5A' for 'Fig 5'

(Page 14, clause 10.1) — Substitute 'IS 1570 (Part 2/Sec 1)' for 'IS 1570 (Part 1)'

(Page 14, clause 10.3) — Add 'Tool types' before the letter 'H'

Indian Standard

TECHNICAL SUPPLY CONDITIONS FOR TWIST DRILLS

(Second Revision)

1 SCOPE

This standard covers the material, hardness, general requirement, marking and packing for twist drills

1.1 This standard also specifies the performance test for normal (N) twist drills hard (H) or soft (S) twist drill may be tested as agreed to between the manufacturer and the purchaser

1.2 The requirements covered in this standard are not applicable to carbide tipped twist drills, drills to be used on wooden material, hand operated twist drills and roll forged drills

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below

IS No	Title
1570 (Part 1) 1978	Schedules for wrought steels Part 1 Steels specified by tensile and/ or yield properties (<i>first revision</i>)
1715 2002	Dimensions for self holding taper (<i>third revision</i>)
7291 1981	High speed tool steels (<i>first revision</i>)
10915 1984	Terms, definitions and types of twist drills

3 TERMINOLOGY AND TYPES

For the terms, definition and types of twist drills, reference shall be made to IS 10915

4 MATERIAL

- a) One piece construction High speed steel
- b) Two piece construction
 - Cutting portion High speed steel
 - Shank portion Carbon steel with tensile strength 700 MPa, *Min* (before construction)

NOTE — Unless otherwise specified, the high speed steel shall be of designation XT87W6Mo5Cr4V2 or T72W18Cr4V1 according to IS 7291 or equivalent, in which case the major constituents shall be specified by the manufacturer

5 HARDNESS

- 5.1 a) Cutting portion 760 HV, *Min*
900 HV, *Max*
 - (Measured on land)
- b) Shank portion
 - Parallel shank one piece construction 240 HV, *Min*
Maximum hardness shall not exceed the hardness of the cutting portion
- c) Two piece construction 185 HV, *Min*
450 HV, *Max*
- d) Morse taper shank (after construction) 185 HV, *Min*
- e) Tang of morse taper shank
 - 1) For drills of diameter below 10 mm 185 HV, *Min*
 - 2) For drills of diameter 10 mm and above
 - i) One-piece construction 240 HV *Min*
450 HV *Max*
 - ii) Two-piece construction 320 HV *Min*
450 HV *Max*
- f) Driving tenon 240 HV *Min*
Maximum hardness shall not exceed the hardness of the cutting portion

5.1.1 The hardness shall be determined on the body clearance if the width of land is less than 2 mm, otherwise the hardness shall be determined on the land

IS 5099 : 2003

5.1.2 The method for testing of hardness given in Annex A shall be used

6 GENERAL REQUIREMENTS

6.1 Dimensions and Tolerances

According to relevant Indian Standard for a particular drill

6.1.1 Tolerance for parallel shank shall be h11 and tolerance for drills with back taper shall be f11

6.2 Point

- Point angle, unless 118°, approximately otherwise specified
- Lip clearance angle 8°, Min

6.2.1 The point shall be concentric with shank. The cutting lips shall be equal, straight and equally inclined to the axis

6.3 Parallel Shank

The back taper may be provided on stub series and jobber series twist drills in one of the following ways, at the discretion of the manufacturer

- The diameter reduces uniformly from the point to the end of the parallel shank,
- The diameter reduces uniformly from the point towards the shank but the reduction is applied only over the fluted portion. In this case, the shank diameter is the same as the nominal diameter of the drill, and
- The diameter reduces uniformly from the point towards the shank over the fluted portion and then remains constant towards the back to give a parallel shank. In the case, the shank diameter is less than the nominal diameter of the drill

6.3.1 In case of twist drills having a flute length longer than the jobber series, the back taper shall be provided according to 6.3 (b) only

6.3.2 Back taper shall be provided on cutting portion drill. The value of the back taper shall be 0.02 to 0.08 mm per 100 mm flute length

NOTE — Back taper is not obligatory for diameter less than 3.00 mm but in no case shall be diameter at point be less than of the rest of flute portion

6.4 Morse Taper Shank

Dimensions of morse taper shanks shall be according to IS 1715 with a cone tolerance of AT7. Cone angle tolerance of AT7 quality is given in Table 1

6.5 Radial Runout Tolerance, T_r

The radial runout tolerance T_r of the twist drill shall

be as given in Fig. 1 and shall be calculated by equation

$$T_r = 0.03 + 0.01 \frac{l}{d}$$

where

l = total length, and

d = diameter at the cutting edge, in mm

NOTES

1 The tolerance values given in the graph, take into account an error probability limit of 90 percent

2 The runout value specified are over the entire flute length with respect to the shank

Table 1 Cone Angle Tolerance of AT7 Quality
(Clause 6.4)

Sl No	Range of Cone Length (L mm)	AT _α		AT _D ¹⁾ μm
		μrad	minutes, seconds	
(1)	(2)	(3)	(4)	(5)
i)	40 ≤ L ≤ 63	315	1'05"	12.5 20
ii)	63 < L ≤ 100	250	52"	16 25
iii)	100 < L ≤ 160	200	41'	20 32
iv)	160 < L ≤ 250	160	33"	25 40

¹⁾ AT_D is calculated from the constant AT_α value within range of cone lengths

6.6 Web (Core) Thickness and Web Symmetry

The limits of web thickness shall be as given in Fig. 3 A. In any case the core thickness as indicated in Fig. 2 shall not be less than values as shown in Fig. 3 A. The tolerance on the web symmetry 't' about the drill axis in a plane perpendicular to that axis as shown in Fig. 2 shall not be greater than that given in Fig. 3 B. The measurement shall be taken at the point or behind any thinning of the web

6.6.1 Definition of Web Symmetry Tolerance

The web symmetry tolerance 't' stated in Fig. 2 is defined as follows

The median plane of the web shall be located between two parallel planes t apart, which are symmetrically disposed about the datum axis of the drill. This can lead to a deviation between the median plane of the web and the axis of the drill of $t/2$

6.6.2 Measurement Method

The measurement method illustrated in Fig. 3 C complies with the definitions given in 6.2.1.

The twist drill is located in a vee block, at the point or behind any thinning of the web, a zero setting is made on one side of the web, then the twist drill is rotated through 180°, the corresponding reading of the dial gauge 'X' shall be smaller or equal to t

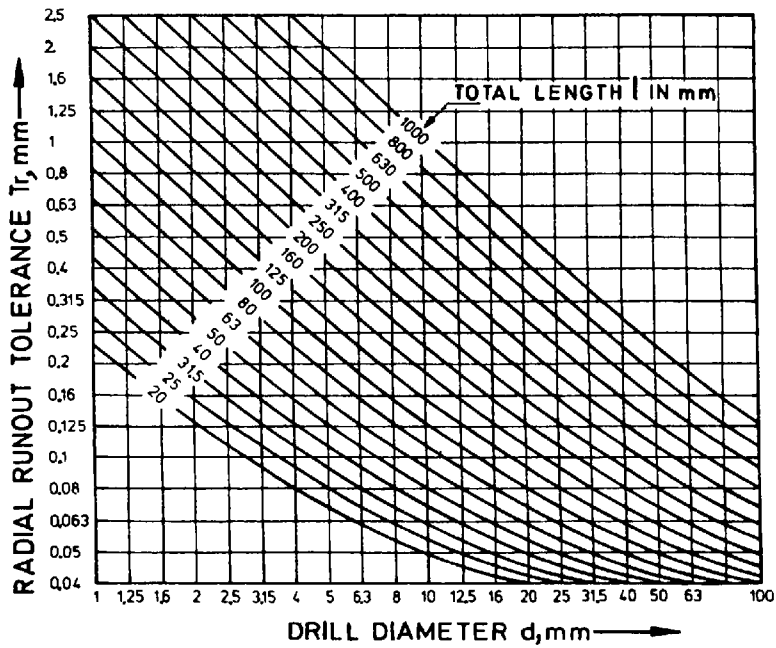


FIG 1 RADIAL RUNOUT TOLERANCE, T_r

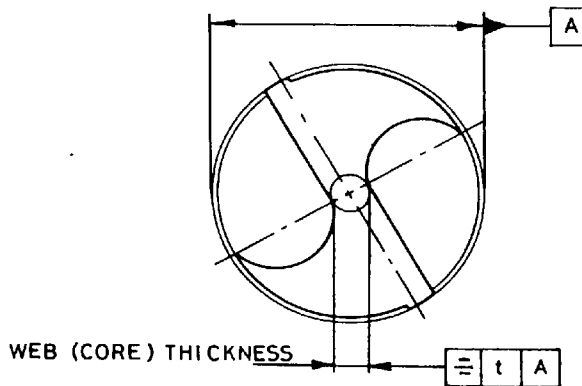


FIG 2 WEB (CORE) THICKNESS

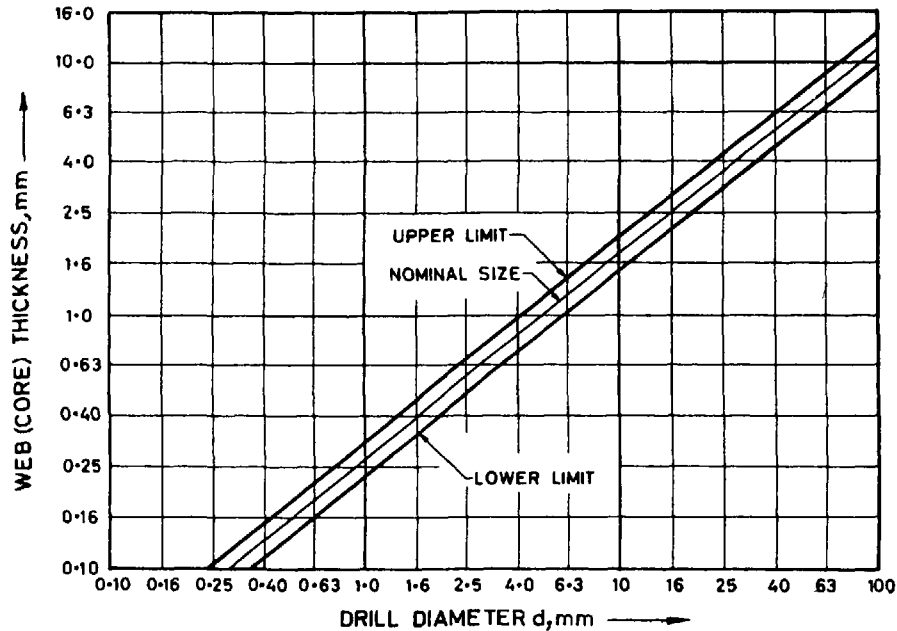


FIG 3A LIMITS OF WEB THICKNESS

6.7 Width of Land

The limits of land width shall be as given in Fig 5. In any case the land width as indicated in Fig 4 shall be within the region of values as shown in Fig 5A.

6.7.1 Relative Lip Heights

The maximum permissible difference in height of the two major cutting edges (lips) of a drill measured at outer corners shall be limited to a value below the line shown in Fig 5B.

6.7.2 Flute Spacing

The maximum difference in pitch between the two major cutting edges (lips) of a drill measured as close as possible to the outer corners shall not exceed the values given by the line shown in Fig 5C.

6.8 Side Rake Angle, γ_f

The recommended values of side rake angle γ_f (see Fig 6) in relation to the tool-types N, H and S as explained in 6.9 and the drill diameter, shall be as given in Fig 7A, 7B and 7C.

6.9 Point Angles

The point angle (see Fig 8) for types N, H and S shall be as given in 6.11. If the drill is required with some other point angle, the same be suitably mentioned in the order.

6.10 Special Point Grinding Methods

The special point grinding methods to suit particular type of material or working condition shall be as shown in Fig 9.

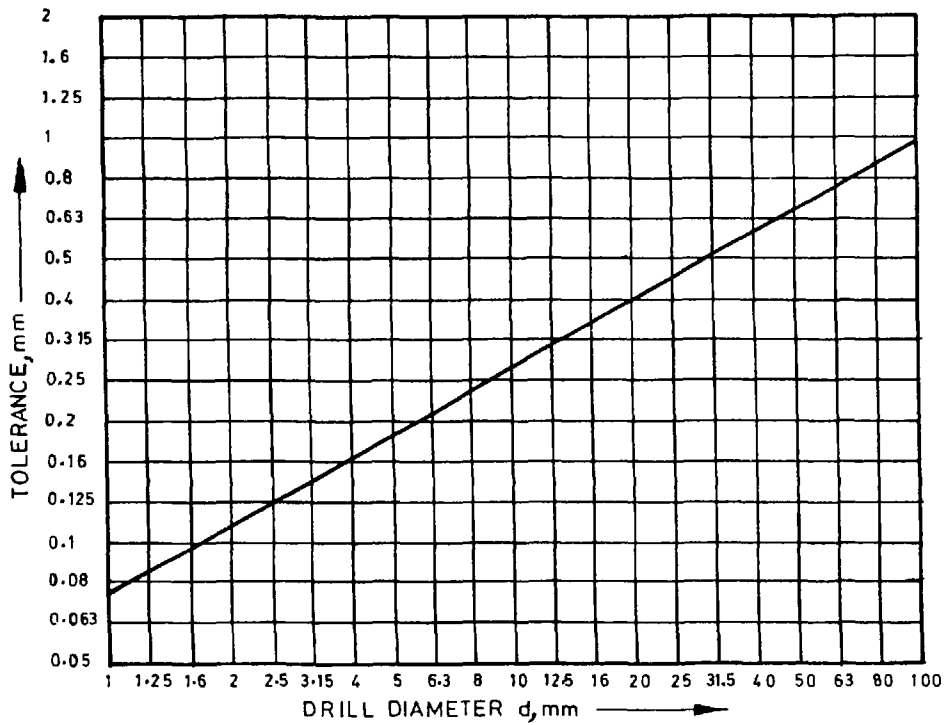


FIG 3B TOLERANCE ON WLB SYMMETRY — LIMITS OF THE TOLERANCE

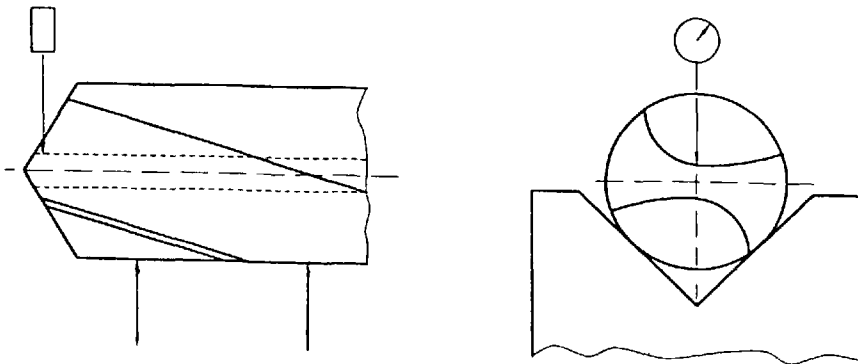


FIG 3C MEASUREMENT METHOD

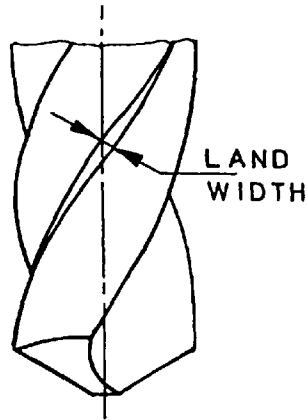


FIG 4 WIDTH OF LAND

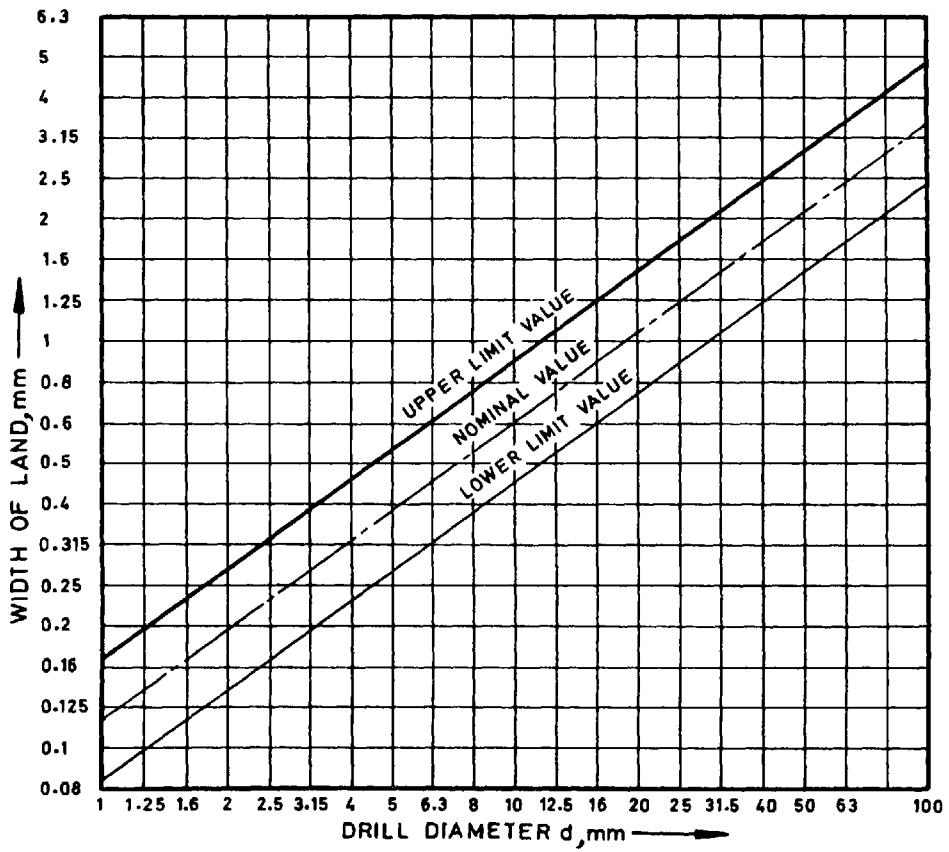


FIG 5A LIMITS OF LAND WIDTH

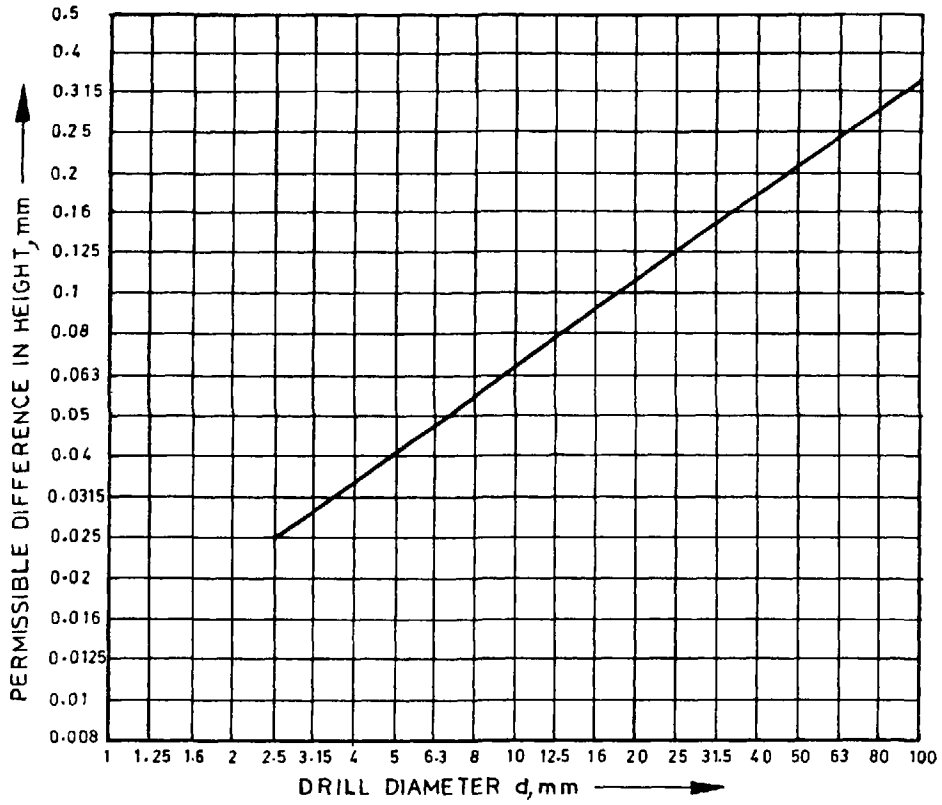


FIG. 5B PERMISSIBLE DIFFERENCE IN HEIGHT OF MAJOR CUTTING EDGES

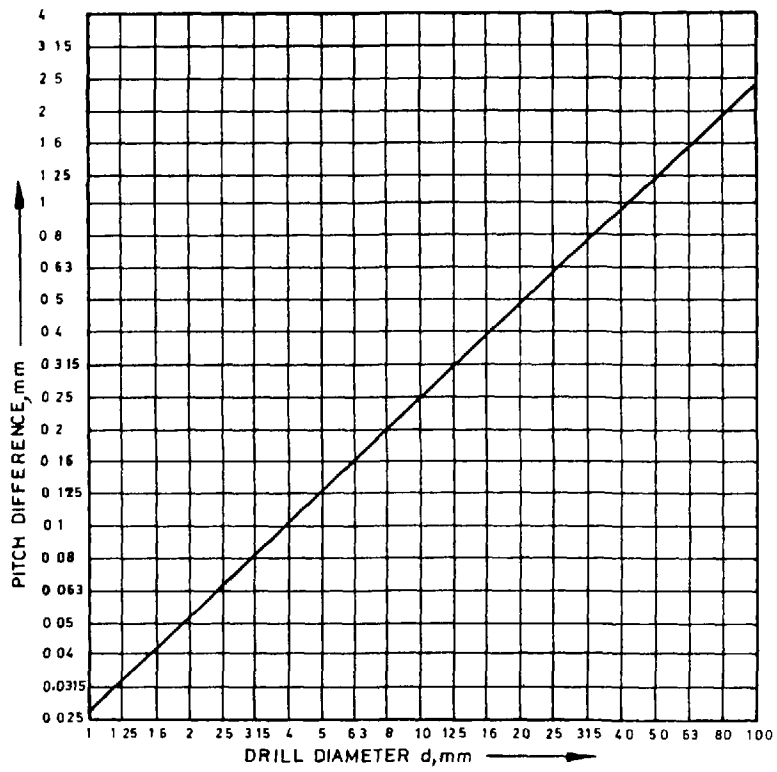


FIG 5C MAXIMUM PERMISSIBLE VARIATION IN FLUTE SPACING

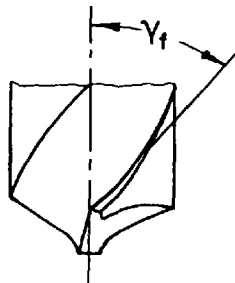
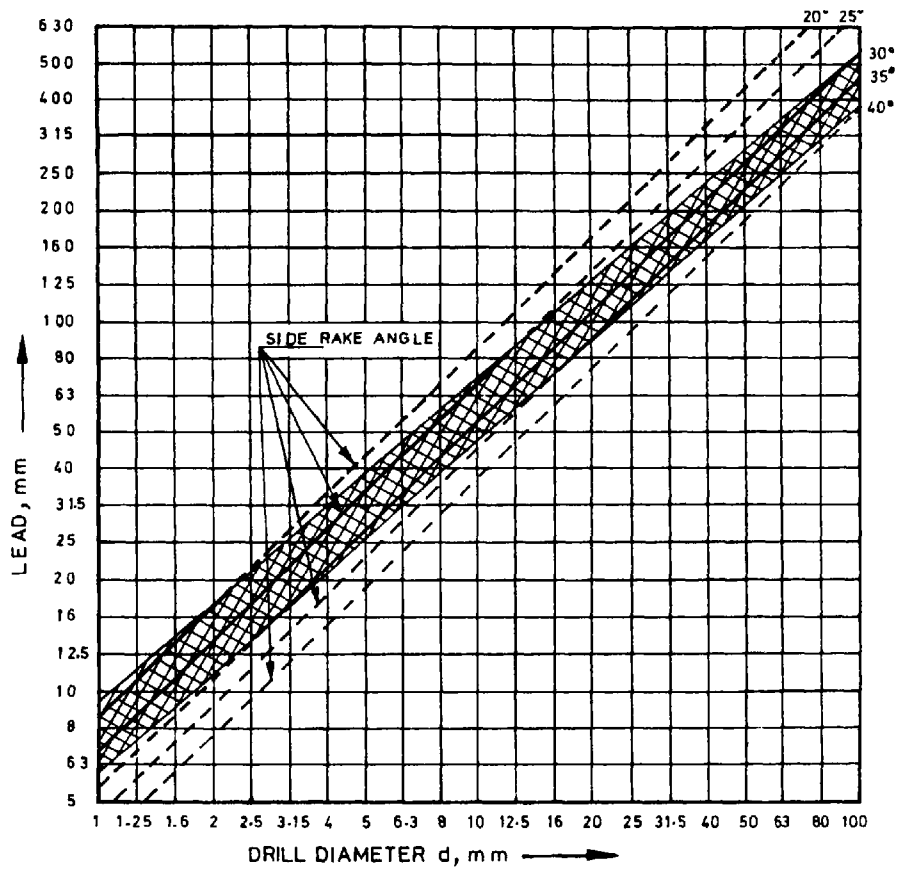
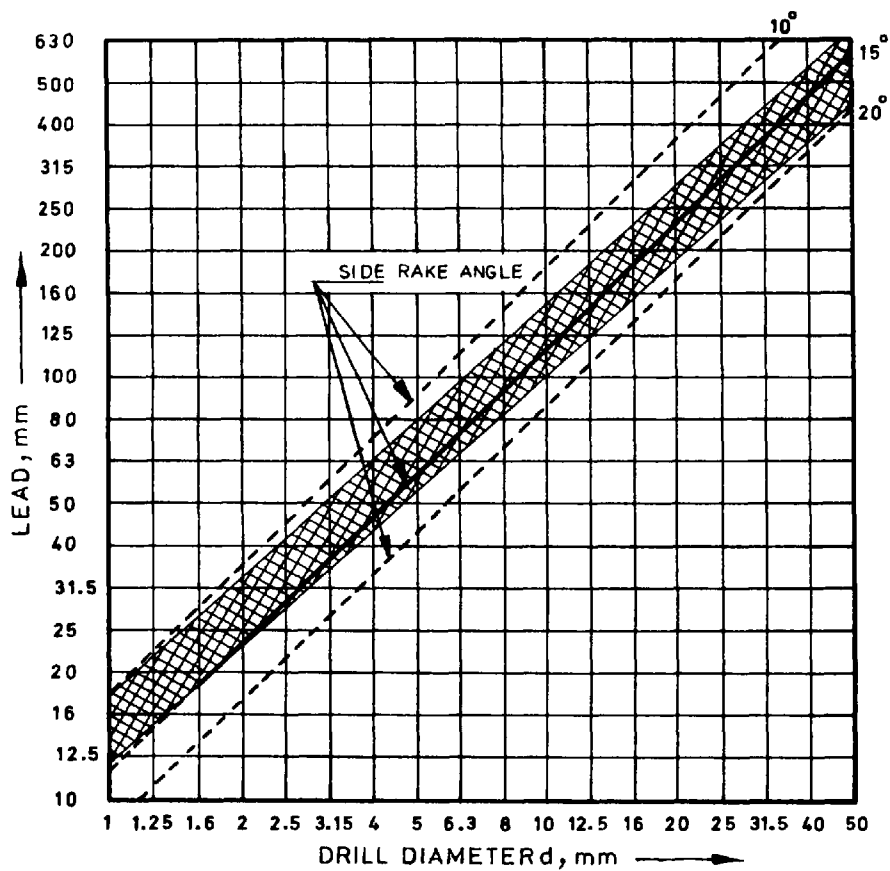


FIG 6 SIDE RAKE ANGLE, γ_f



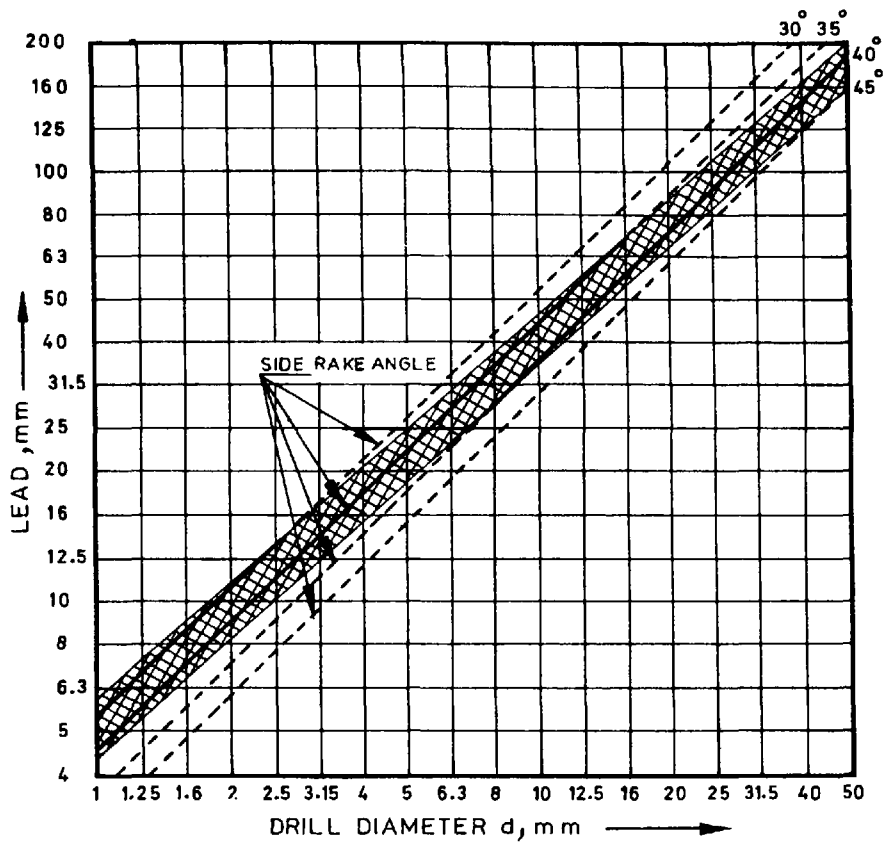
NOTE — Shaded portion indicates the recommended range of lead and side rake angle

FIG 7A LIMITS OF SIDE RAKE ANGLE, γ_s FOR TYPE N



NOTE — Shaded portion indicates the recommended range of lead and side rake angle

FIG 7B LIMITS OF SIDE RAKE ANGLE, γ_f FOR TYPE H



NOTE — Shaded portion indicates the recommended range of lead and side rake angle

FIG 7C LIMITS OF SIDE RAKE ANGLE, γ_f FOR TYPE S

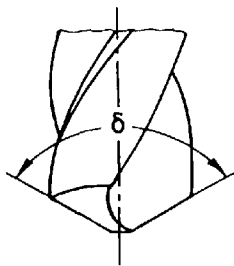


FIG 8 POINT ANGLE

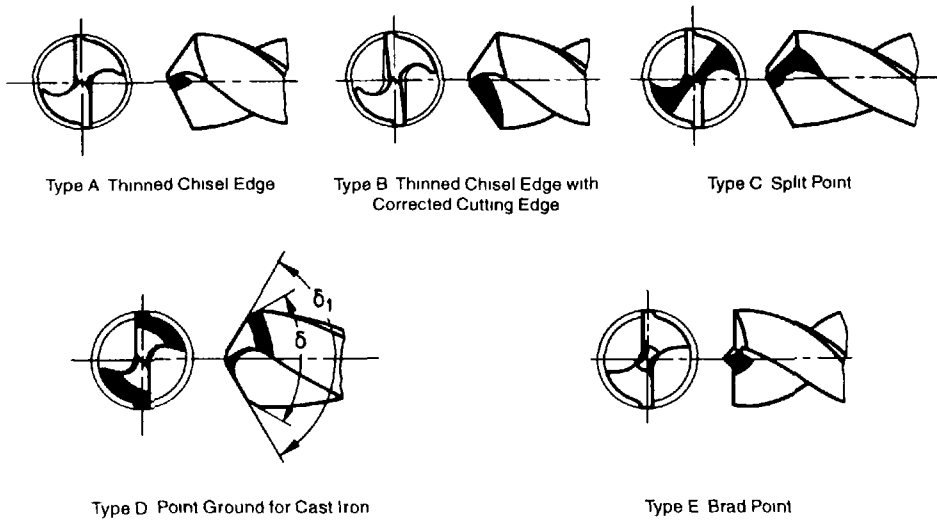


FIG 9 SPECIAL POINTS GRINDING METHODS

6.11 Recommended Tool Types and Point-Angles for Various Materials

<i>Material of Workpiece</i>	<i>Tensile Strength MPa</i>	<i>Brinell Hardness HB</i>	<i>Tool Type¹⁾</i>	<i>Point Angle ±3°</i>
Steel and cast steel (alloyed and unalloyed)	400 to 700 700 to 1200	115 to 205 205 to 350	N N	118° 130°
Stainless steels			N	140°
Austenitic steels			H	140°
Cast iron		140 to 200 200 to 240 Over 240	N N N(H)	118° 118° 118°
Malleable cast iron			N	118°
Brass				
with copper up to 58%			H(N)	118°
with copper above 58%			N	118°
German silver			N	118°
Copper				
up to 30 mm drill diameter			S(N)	140°
over 30 mm drill diameter			N	140°
Aluminium alloys,				
long chip type			S(N)	140°
short chip type			N	140°
Magnesium alloys			H(N)	140°
Nickel			N	118°
Zinc alloy			S(N)	118°
White metal			S(N)	118°
Moulded plastics				
thickness ≤ drill dia			H	80°
thickness > drill dia			S	80°
Laminated plastics			H(N)	80°
Celluloid			S(N)	140°
Hard rubber and thin plastic material			H(N)	80°
Marble, slate and carbon			H	80°

NOTE — The twist drills are made in three tool types, namely, Normal (N), Hard (H) and Soft (S) depending upon the material to be drilled

¹⁾ Tool types within brackets are non-preferred

7 WORKMANSHIP AND FINISH

Drills shall be supplied well finished, sharpened, free from burrs and ready for use

8 MARKING

8.1 Drills of 3 mm diameter and above shall be marked with the following

- Diameter, *d*,
- Material of cutting portion (HSS — for high speed steel), and
- Manufacturer's name or trade-mark

8.1.1 The marking shall be so applied and finished that it does not interfere with the secure holding of the drill

8.2 In case of twist drill below 3 mm diameter, the marking shall be done on the packing

9 PROTECTIVE COATING AND PACKING

9.1 Each twist drill shall be covered with a suitable rust-proofing material

9.2 Each twist drill or a number of drills shall be wrapped in non-absorbent paper protected by a cover bearing the size, material and the manufacturer's name, initials or trade-mark

9.3 Twist drill of only one size shall be packed in one carton

10 TESTING OF TWO-FLUTE PARALLEL SHANK AND MORSE TAPER SHANK TWIST DRILLS (APPLICABLE TO DRILLS OF TOOL TYPE 'N' ONLY)

10.1 Test Billet

Material	Similar to 45C8 according to IS 1570 (Part 1)
Hardness	190HB to 220HB (94 HRB to 97 HRB)
Grain size	No 3 to No 6 (ASTM)
Thickness of billet	Greater than the depth of hole to be drilled

10.2 Method of Test

- The drills shall be subjected to test by drilling a series of holes as continuously as possible in the test billet
- The drills shall be flooded with coolant throughout the test
- The drills shall be initially guided by hand feed and the power feed shall be thrown into

mesh immediately, when the outer corners of the drill reach the surface of the test billet

- The speeds for testing of high speed steel twist drills shall be 20 m/min, *Min*. The feed per revolution shall be left to the discretion of the manufacturer, so that the penetration per minute is within ± 10 percent of the value specified in 10.4
 - The drills shall withstand the specified tests without seizing, choking or fusing. The points of drills and tips shall be fit for further service on completion of the tests. However, if the drill gets blunt or breaks before the completion of the specified test and if there is reason to doubt that such failure may be due to the existence of hardspot in the billet or due to wrong methods of test employed, etc, the same drill after re-sharpening or a fresh drill from the same batch shall be again tested
- If any of the drills first selected does not fulfil the test requirements, two further drills of the same batch selected and if either of these drills fails, the batch represented shall be deemed not to comply with the requirements of this standard and shall be liable for rejection
- The tests shall be carried out at the manufacturer's works, or elsewhere as may be mutually agreed upon

10.3 H and S drills may be tested as agreed to between the manufacturer and the user

10.4 Performance

Nominal Diameter	Penetration per Minute ¹⁾	Number of Holes to be Drilled	Depth of Holes to be Drilled ²⁾
(mm)	(mm)		(mm)
3.20	215.9	24	11
3.60	221.0	24	11
4.00	223.5	24	15
4.50	228.6	24	15
5.00	233.7	24	15
5.60	236.2	20	19
6.30	241.3	20	19
7.10	238.8	20	23
8.00	233.7	20	23
9.00	232.4	18	27

¹⁾ For long series twist drills, penetration rate shall be reduced by 20 percent

²⁾ From the outer corners of twist drill to the surface of the billet in the drilled condition

Nominal Diameter	Penetration per Minute ¹⁾	Number of Holes to be Drilled	Depth of Holes to be Drilled ²⁾
(mm)	(mm)		(mm)
10.00	228.6	18	31
11.20	223.5	18	35
12.50	217.2	18	35
14.00	209.5	15	43
16.00	200.7	15	43
18.00	190.5	15	51
20.00	180.3	14	59
22.40	172.7	14	59
25.00	160.0	14	67
28.00	149.9	9	76
32.00	134.6	9	76
36.00	119.4	9	76
40.00	106.7	9	76
45.00	94.0	8	76
50.00	78.7	8	76

Nominal Diameter	Penetration per Minute ¹⁾	Number of Holes to be Drilled	Depth of Holes to be Drilled ²⁾
(mm)	(mm)		(mm)
56.00	68.6	6	76
63.00	60.5	6	76
71.00	52.1	4	76

NOTES

1 The rate of penetration for twist drills below 3 mm and above 75 mm diameter shall be as agreed upon between the manufacturer and the purchaser

2 The rate of penetration for intermediate diameters shall be obtained from the figure. The number and depth of holes shall be as for the next larger size

3 The penetration rate per minute given in the table may be within ± 10 percent of the value, depending upon the speeds and feeds combination available in the machine utilized for testing purpose

10.5 Penetration Rate

Penetration rate shall be as per graph given in Fig 10

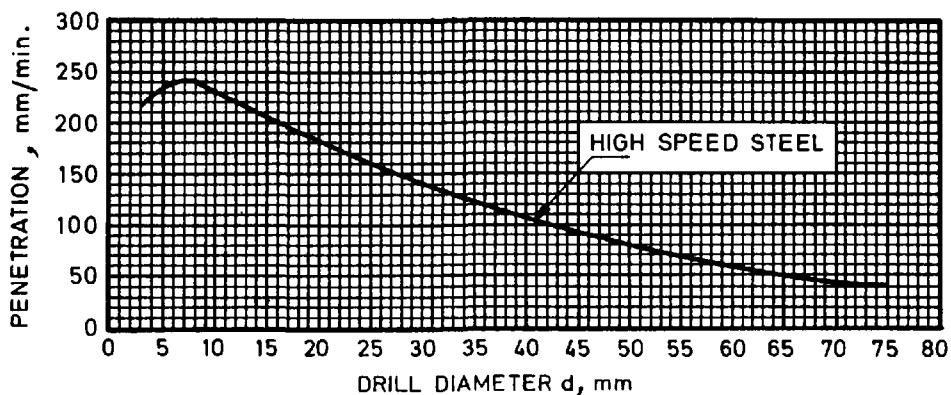


FIG 10 PENETRATION RATE

¹⁾ For long series twist drills penetration rate shall be reduced by 20 percent

²⁾ From the outer corners of twist drill to the surface of the billet in the drilled condition

¹⁾ For long series twist drills, penetration rate shall be reduced by 20 percent

²⁾ From the outer corners of twist drill to the surface of the billet in the drilled condition

ANNEX A*(Clause 5.1.2)***RECOMMENDED METHOD OF TEST FOR HARDNESS OF TWIST DRILLS**

<i>Drill Diameter (mm)</i>		<i>Element on which the Hardness is to be Checked</i>	<i>Load to be Applied on the Vickers Hardness Tester (N)</i>
<i>Over</i>	<i>Up to and Including</i>		
1	3	Grind a small flat on the chisel point (1mm minimum) and hold the drill vertically and check the hardness on this flat portion Re-sharpen the point immediately after checking	10
3	5		25
5	8		50
8	20	Hold horizontally and check on the circular land	100
20	—		300

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Amendments Issued Since Publication

Amend No	Date of Issue	Text Affected

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